

SCIENCE.

FRIDAY, APRIL 10, 1885.

COMMENT AND CRITICISM.

THE NOMINATION of Hon. Norman J. Coleman of Missouri to be commissioner of agriculture, if it is to be taken as the expression of a distinct policy on the part of the new administration, shows that no radical change in the status of the department of agriculture is to be looked for. The selection in itself is a commendable one. Mr. Coleman has for years been one of the prominent agriculturists of the Mississippi valley, and, so far as we know, is well fitted by his knowledge of practical agriculture, and his experience of men and affairs, for the position to which he has been nominated. We believe he will compare favorably with previous commissioners. But, whether Mr. Coleman be better or worse than his predecessors, the difference is in degree. We do not understand that he has, or claims to have, any special and intimate acquaintance with the science of agriculture, and we do not anticipate that under him the department will be essentially other than it has been. Its organization as a scientific bureau, with a technical expert at its head, as advocated in a recent number of *Science*, is apparently as remote as ever.

THE IMMEDIATE effect of a meeting of the American association for the advancement of science is a large increase in its membership, not only in the place which offers its hospitalities any given year, but also in the whole section of which the place is a centre. Thus the meeting in Philadelphia last year not only increased the membership in that city from 56 to 150, but spread its influence into the whole surrounding region; so that, whereas a year ago there were in Pennsylvania only 111 members, there are now 267, while the membership in New Jersey has also increased from

50 to 73,—a total increase in these two states of nearly the entire advance which was made in the list of membership of the association for the past year. It now numbers 2,347 members, against 2,011 last year. The membership in Philadelphia is thus at once raised to the first rank, in which only three cities may claim a higher place,—New York, with 171; Boston, with 161; and Washington, with 155 members.

How long this membership is retained in such places seems to depend largely upon circumstances. It may be noted, however, that in no place where the meeting has been held since the civil war, until the meeting in Boston (at which the membership was at once doubled), are there more than two cities—Chicago (1868, 30 members) and St. Louis (1878, 52 members)—where there are now more than twenty-five members. In four of them, indeed, there are less than ten, of which Dubuque (1872), with its single member, is the most striking example. With its great increase of membership, it is now, more than ever, plain that the association can only meet in cities of considerable size, unless it be in a university town, or in some far-off place where the expense of travel compels a small attendance. The falling-off of membership in the cities which have held the association since it grew to enormous proportions, has not been very large, at least during the past year, and offers great hope that a much more permanent interest in the association is secured by one of these meetings than could be expected. Thus Boston, where the association met in 1880, gained five members last year; Cincinnati lost nine; Montreal, four; while the membership at Minneapolis remained the same.

We have scanned the list with a view of finding out how largely membership in the association is influenced in smaller places by

such an interest in science as is indicated by the presence of local scientific societies strong enough to publish proceedings of some sort; and the result appears to be, that these societies are not, to any appreciable extent, feeders of the association. It is more probable that they are oftener its children. Thus San Francisco numbers but seven members; Denver, two only, losing one during the past year, which has witnessed the publication of a whole volume of proceedings from the local society; the great city of Chicago has but thirty members, even with an increase of four during the past year; Davenport, Io., has only two; Albany, with its long-established Albany institute, only fifteen, a loss of one during the year; Buffalo, with more than one society flourishing from time to time, eleven, a loss of one member during the year; Poughkeepsie, five, a loss of one; Troy, twelve, a gain of three; Wilkesbarre, six, a gain of four during the past year; Milwaukee, four, a gain of one; Toronto, twelve, a gain of one; and Halifax, N.S., a single member.

University and college towns are very generally represented, but, excepting at large centres, by only three or four members. How widely distributed the membership has become, is shown by the significant fact that no less than 597 places contribute to the list; indicating clearly that the assembling of five hundred or a thousand scattered members once a year, must be an important factor in the advance of science in this country, far more than it is possible it should become in such a country, for instance, as England.

AMONG RECENT naval orders, we note that of Rear-Admiral Franklin to the command of the European squadron. That this able officer, who has been superintendent of the observatory only about a year, should be so soon relieved of his duties and assigned to another station, will be a matter of regret to all those friends of the observatory who hold to the belief that its efficiency under an exclusively

naval management is as great as it ever would be under any other.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The carnivorous habits of the Rodentia.

IN recent numbers of *Science* several observers have spoken of the habit possessed by the muskrat, *Fiber zibethicus*, of feeding upon certain mussels to be found at its places of resort. As already referred to by one of these contributors, instances were brought up before the Biological society of Washington, a few months ago, of their destroying for food-purposes carp in the carp-ponds. I wish to enter here but one additional charge against this animal, which has been the subject of so much abuse lately. Several years ago, when I lived in a town situated upon Long Island Sound, I saw upon a number of occasions, when collecting during moonlight nights, muskrats swimming along the stone wharves where the shipping moored. It never struck me, however, that they were in search of food, until I observed one, on one occasion, dive, and return in a moment to the surface with a fish in its mouth some five or six inches long. I killed the animal in the act, and secured both fish and rat. The former proved to be a specimen of *Gadus tomcod*, — a fish which in early winter swims sluggishly along close to the wharves in those latitudes, and one easily captured, I imagine, by such a good swimmer.

The muskrat, however, does not stand alone in this particular propensity among the Rodentia. While collecting near Fort Wingate, N. Mex., a few days ago, I was so fortunate as to capture alive a specimen of *Hesperomys*, of what species I am not positive as yet. This truly beautiful little animal was taken from its nest in a tree in the immediate vicinity of several lodges of *Neotoma floridana*. On arriving home, about nightfall, it was consigned to a wooden box in my study. My work-table in this room was covered with things familiar to those who are acquainted with the doings of a naturalist in the field. Among them was a vessel containing coarse cornmeal, used in skinning animals and birds. Near this lay fresh specimens of pine-linnets, blue crows, and several other birds, which I intended to convert into skeletons. My *Hesperomys* escaped during the night, and although he had been a prisoner but a few hours, and presumably not hungry, he ate nearly the entire body of one of my pine-linnets, never touching the saucer of cornmeal which stood immediately by it.

Next morning the contents of his stomach proved his guilt. The flesh-eating habits of rats are too well known to call for comment in this connection.

R. W. SHUFELDT.

Fort Wingate, N. Mex.,
March 20.

Mr. Melville's plan of reaching the north pole.

If you can spare the space in your journal, I would like to make a few concluding remarks on Dr Boas's criticism of my proposed route toward the north pole, and my theory thereon.

Dr. Boas, in his letter to *Science*, confines me to

the hard and fast line of 85° north latitude, where the ice-cap is supposed to be fixed by centrifugal and other forces, and insists on my saying I will have a smooth ice-cap to travel over to the pole; whereas, in both cases, *about* 85° north and a *comparatively* smooth ice-cap are intended.

"And in returning, he intends to use the southern drift of the ice," etc. I speak of, and lean upon, *probabilities* in my theory altogether; and the millions of square miles of ice that drift out of the Arctic Ocean do not come from near the pole. Capts. Nares and Markham, nor any one else, has ever seen a 'paleocrystic sea of ice.' All the ice ever witnessed by the eye of man has been 'broken floe' or drifting 'pack' of but one or two years' growth, or at most of but a few years' growth, that breaks up and drifts away from the outer edge of the ice-cap under discussion.

While drifting in the Jeannette, we observed a large 'old-time' floe piece (about sixteen miles area) that might have been of any age. It certainly was very much older than any surrounding ice; and it had the appearance of what might be termed a *piece* of the paleocrystic ice-cap near the pole, that had been broken off farther up into the upper 'fringes' of the cap, and had drifted away.

This floe piece has no reference to bergs that are made upon the land, and take ages to form, but to the ice of the salt sea. Hard as dolomite, and of the dead color of marble, it was entirely different from the pack and floe ice of 70° or 80° north latitude. This is one more reason why I believe, that, as we proceed toward the pole north of 85° , we should find the disputed ice-cap formed of this older ice.

Dr. Boas says, that, "if it can be proved that an ice-cap cannot exist, his [my] plan must needs fall to pieces. . . . No doubt the centrifugal pull at a certain parallel will be equal on every meridian," etc.

But the very mile of ice that Dr. Boas depends upon to pull the ice-cap from its place, and hurl it down toward the equator, is just the mile or miles of ice that break away from the ice-cap because of the weakness of the ice at the fringes; and, as it breaks away, the cap regains its equilibrium. Whether the strength of the ice at the pole will withstand the centrifugal force, tending to carry it toward the equator, will depend upon the velocity of that force, and the amount of hold and the number of holds the islands have upon the cap, as well as the contending currents and other forces that are continually at war with each other. And I do not concede that my argument referring to an equal pull (comparative and then equalized again) by the centrifugal force cannot be maintained.

Even though all my theories fall to the ground, I am doing just what Dr. Boas wants his readers to believe I am not doing; that is, I am not depending upon my theories alone for my scheme of advance toward the pole, but I am depending upon the lessons taught by 'former experiences,' and 'not on vague theories.'

I propose to go by way of Franz Josef Land, for the reasons that it is the northernmost land known on the face of the earth; it is readily accessible every year; retreat from this land is sure and safe. By this route alone are we enabled to hold to the land to the farthest point north, and I would not leave the land at all if it extends all the way to the pole.

But if it does not extend all the way to the pole, then I must take to the ice, over which I believe I will have easy travelling, compared to that south of 80° , where the motion is greater than toward the pole, and where most of the observations of

the ice conditions have been made. All, all else is theory.

I have no desire to go to the Arctic to perish. It is my knowledge, founded on personal experience and that of others that I have studied intently, that makes me believe that I can go to the pole *via* Franz Josef Land with a greater degree of safety than by any other route, and *that it is the route of the future*.

I thank Dr. Boas for his courtesy and words of praise. I do not class him with the narrow-minded obstructionists of whom he speaks; but I cannot agree with his hair-splitting arguments, or his hard and fast lines of demarcation, in which he insists that my theories are based on erroneous data, or in opposition to the standard authorities of the day.

GEORGE W. MELVILLE,
Chief engineer U. S. navy.

Columnar structure in sub-aqueous clay.

During the summer of 1883, in the vicinity of Menomonee, Dunn county, Wis., I was fortunate enough to see, while it was still fresh, a deep railway cut through the sub-aqueous clays which overspread that region, reaching up to considerable altitudes above the Red Cedar River. The cut was something less than a hundred feet above the stream, and between twenty-five feet and thirty feet deep. Beneath the shallow soil was a stratum of distinctly laminated brown-yellow clay-loam about ten feet in thickness. Beneath this was a stratum of clay of a peculiar greenish hue, also distinctly laminated, and through which occasional sandy partings were traceable. This stratum was about five feet in thickness, and was followed, in descending order, by stratified sand, which extended to the bottom of the cut.

In the second clay stratum, reckoning from the top, columnar structure was beautifully developed. Not only was this structure conspicuous as seen in the nearly vertical face of the cut, but several of the hexagonal columns had individually separated from the others, and, after falling a number of feet from their natural position, still preserved their integrity as they lay at the bottom of the cut. The columns varied in diameter from ten to fifteen or sixteen inches. They were uniformly, but not regularly, six-sided, and could be divided easily across their longer axes, parallel to the bedding planes, so that each column was separable into regular sections. Whenever this parting was made (and the experiment was repeated several times), the opposing surfaces, after separation, were never plane, but always showed a greater or less curvature, convexity fitting concavity. If my memory serves me rightly, the convexity was at the lower end of each section, though, unfortunately, I find nothing in my notes on this point.

Another interesting feature was observable on the cross-section surfaces; viz., a distinctly concentric structure. This, in some cases, was very conspicuous; in others, to be discovered only on close inspection. In more than one case, the concentric lines, which were real structure-lines, and not merely lines of coloration, were almost continuous around the column, but they were more commonly somewhat interrupted. The concentric lines were generally very numerous, and therefore closely approximate, and more commonly best developed just about the centre, or else near the exterior of the column.

This structure would seem to be an additional confirmation of the hypothesis which ascribes columnar structure to concretionary action.

Beloit, Wis., March 25.

R. D. SALISBURY.

PERIPATETIC SCIENCE TEACHING.

A VERY interesting experiment is being tried in Birmingham, by way of showing with what good results science can be taught to quite young children by a teacher who goes from school to school, and has his apparatus carried around with him. There is something very amusing to an American—it would be hard to say exactly why—in the description given in *Nature* of a ‘strong youth’ dragging through the city his ‘hand-cart’ laden with apparatus, and, when he reaches a school, unpacking it, spreading it out on a table, and retiring at the moment the demonstrator steps in. But after enjoying the local color of the picture, it may be well to ask ourselves whether the plan is not a good one, and deserving of imitation in our own public schools. In this country, no form of science-teaching is introduced, as a general thing, below the high school. The Birmingham course is given to children of from ten to thirteen years of age. One lesson fortnightly, of about forty minutes’ duration, is given in the fifth and higher standards in each school. Between the visits of the science-demonstrator, at least one lesson is given to the class by the teachers of each school (as a rule, by a teacher who was present at the demonstrator’s lesson, and who took full notes of it), and a written examination in the subject-matter of the lesson is also held. Most of the apparatus is of the simplest form, and so made that it can be taken to pieces, and examined in detail, by the children. Much of it Mr. Harrison has himself designed and had made for the purpose. His plan is to prepare working-models, pictures, and diagrams of pumps, for instance; to have the apparatus arranged on the table; and to draw from the boys what they know about pumps before telling them any thing. He then shows them the working of the machine, explains its principle, and reminds them of other instances in which they have seen the same principle at work. Before he comes to them again, the regular teacher goes over the ground once more; and then the boys write out what they have learned, and

make drawings of the objects from memory. Some of the papers which we have seen showed a remarkable degree of intelligent comprehension; and one of the most interesting cases in the education department of the London health exhibition was that which contained a set of mechanical apparatus made by the boys at home with no better tool than a jack-knife.

The course extends over three years. For the last year, the syllabus covers the mechanical powers, liquid pressure, the parallelogram of forces, and the parallelogram of velocities. The second year is devoted to food, and to the warming, cleaning, and ventilation of the dwelling. The topics discussed in the eighteen lectures of the first year are not those which we should expect to find in a course on mechanics. The second lecture, for instance, is devoted to the human body, its structure, and the use of the microscope: and on succeeding days are discussed oxygen, hydrogen, nitrogen, amyloids, albuminoids; the composition of milk, eggs, etc.; wool as a material for clothing; hard and soft water; the skin; and soap and soda.

There are two distinct features in the Birmingham plan whose merits need to be discussed separately,—teaching science by means of a single teacher and set of appliances for several schools, and teaching it to very young children. With regard to the latter question, we shall have something to say at another time; but, whatever one may think about teasing children ten years old with such hard things as amyloids and albuminoids, there is no doubt, that, if it is to be done at all, it can be done best by a peripatetic teacher. Good science-teachers do not grow on every bush; and, when one has been found, it is a pity not to use him with as great economy as possible. Few of the teachers now in grammar-schools have received any scientific instruction: still less have they been able to acquire the methods, which are far more important than the facts. The attempt to teach the teachers *en masse* would probably not be very successful. There are comparatively few grown people who can go back to the child’s delight in asking

questions of the things themselves. They do not care to pull the doll or the toy to pieces: they would rather be told what it is made of than take the trouble to examine it. The element of curiosity seems to have been educated out of them, and their only idea of teaching elementary science is to give the children as many facts as possible about things which they know only by their definitions. Until, then, the present happy generation of children has grown up and become ready to teach science by scientific methods, it seems evident that the plan of itinerant teaching has much to commend it. It is a plan, moreover, whose advantages ought not to be confined to the grammar-schools. Instead of putting a single overworked teacher in charge of all possible sciences in a high school, specialists might be found who would go from school to school, and carry with them an enthusiasm which it is impossible to feel for a very wide range of subjects. The Johns Hopkins university has already tested the excellence of the method for higher schools of learning. It is not impossible that the smaller colleges would gain by it if they were to adopt the plan of making occasional exchanges among their professors. In no other way could they so easily secure the specialization which is necessary for the best teaching.

AN ESTIMATE OF GENERAL GORDON'S SCIENTIFIC CHARACTERISTICS.

IN our eagerness to honor a hero, there is some danger that Gordon's fame may suffer temporary injury, and that his character and the nature of his deeds may be seriously misunderstood. The popular notion seems to be, that he lived in a state of mystical exaltation, and won his strange successes by powers and processes incomprehensible, if not supernatural. Recent writing about him has dwelt so particularly upon his religious fervor, and much of it has been so intemperate and indiscriminating, that it is not strange that some shallow pamphleteers should have classed him with the prophets. He was a hero. Besides that, he was a highly educated, disciplined, and painstaking officer. He inherited military talent, and love for his profession, from generations of soldiers, and he was trained in that

thoroughly scientific corps, the Royal engineers. For the first three years of his service under the khedive, he kept careful itineraries of all his marches, and, being a fine topographer, he made solid contributions to our knowledge of the geography of the upper Nile country. I have before me a dozen sketch-maps of the equatorial country, drawn by his own hand with uncommon skill. He was fond of illustrating his letters and memoranda of instructions with geographical and topographical sketches. He was minutely careful in his arrangements for solidifying and extending his communications and positions, fertile and ingenious in applying his knowledge. If we ever learn the details of his defence of Khartum, we shall probably be as much astonished by its mechanical side as by its higher intellectual and moral qualities.

From the beginning of his career before Stevastopol, "He had a personal knowledge of the enemy's movements, such as no other officer attained." His knowledge of the people of the Sudan, of their sheiks and fakirs, and of the Egyptian officers serving there, was remarkable. He had great capacity for detail; but his mental processes were so rapid, and his perceptions so keen, that he was often thought illogical by those who could not keep up with him. He was often misjudged, too, because he would not bother to explain all his steps.

Far from being a mystic, he was wide awake and practical. In Africa and in China he was constantly vigilant in keeping his powder dry. The clothes, food, pay, and sanitary conditions of his soldiers were diligently watched over. The infirmities of temper of his subordinates were well understood and provided for. His campaign in China may well be studied as a shining example of skilfully planned warfare; and his scheme for the better government of the Sudan involved twelve years of logical and systematic development, before its effect could be fully felt.

Let no one think that Gordon mounted his camel and rode into the desert, or seized his stick and led his rascals up to the mouths of the Chinese cannon, with a magnificent but blind faith. He was a laborious student of the problem in hand, he had a keen intelligence, his judgment was prompt and accurate, he was patient and far-seeing, his will was indomitable; but, above all, he had eliminated himself entirely from his problem. This made Gordon great. He could see what other men could not, and do what they dared not, because he was as unselfish as a human being can be.

H. G. PROUT.

THE ROUTE FROM SUAKIN TO BERBER.

This route, estimated by General Gordon during his rapid passage over it in 1874 as about 288 miles in length, and found by Major Prout in his careful reconnoissance in 1875 to be about 255 to 260 miles, is one presenting great and peculiar difficulties to the march over it of a large body of troops; especially between the months of March and November, when the heat is excessive, and when those troops may be required to deal, during the march, with hostile forces.

Starting at sea-level at Suakin, it ends at an altitude of about 1,240 feet on the Nile, at Berber, after having attained at one point an altitude of nearly 3,000 feet.

In its entire length it is practically, *for a large force*, a barren, treeless, waterless desert, but quite different for a small detachment of a few hundred men with their necessary animals. For a large force (say, 5,000 to 10,000 men) the water used by men and horses must in some manner be transported with them or in advance of them.

The wells and water-holes on the whole line may be quickly named and described, as follows: at about 2 miles from Suakin are the wells which furnish water to the town; and here a good supply for a large force may be had. The next water is at El Hundouk, about 9 miles out. These wells furnish partly sweet and partly brackish water, sufficient for about 250 men and 500 animals. At about 17 miles out are the wells of O-Taon, with capacity for, say, 250 men and their horses. In the valley of Sinkat, at about 23 miles, 200 men with 500 animals can usually be supplied by shallow water-holes, which are called the wells of Hambouk; and it is probable, that, by using care, this result might be doubled. Sinkat, nearly 1,000 feet above sea-level, was, in former times of peace and good government, used as a summer residence by the richer merchants of Suakin.

At about 40 miles from Suakin, the wells of Kissibil can furnish good water for a small party, say, a general officer with his staff and escort; and thence on, no water is found until Wady Haratree is reached, at about 64 miles out. Here 600 men and as many animals can drink. Eleven miles farther on, an equally good supply is found at the wells of Salalaat.

The next supply worth mentioning is the well of Abd-el-Hab, where perhaps two battalions might be supplied. This excellent well is 97½ miles from Suakin. At El Ariab, about

118 miles from Suakin, there are three large wells, well constructed, and furnishing good water, in quantity large enough for two or three battalions, with a fair proportion of animals, — a strategic point which should be held by a permanent garrison if the road is to be used.

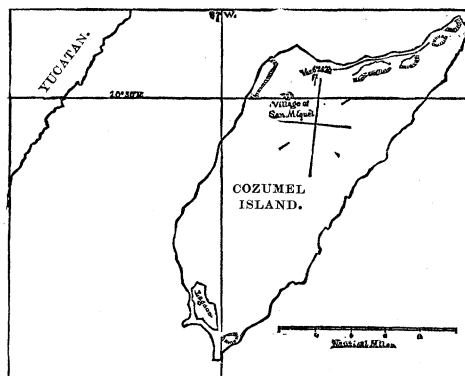
From El Ariab to O-Baek, a distance of nearly 60 miles, no water is found; and even at O-Baek the supply is very disappointing to thirsty marchers, since it is hardly sufficient for a battalion with its animals, and is often brackish. Thence on, the route is in blank desert until within six miles of Berber.

Thus it is seen that on the eastern half of the route there is scant supply of water for the advanced guard of a strong division, while on the western half there is practically no water until within six miles of Berber. Throughout the line, cannon and wagons can be drawn with little difficulty; but the eastern half passes frequently through narrow and tortuous defiles, which an active and intelligent enemy would render extremely dangerous to a marching force.

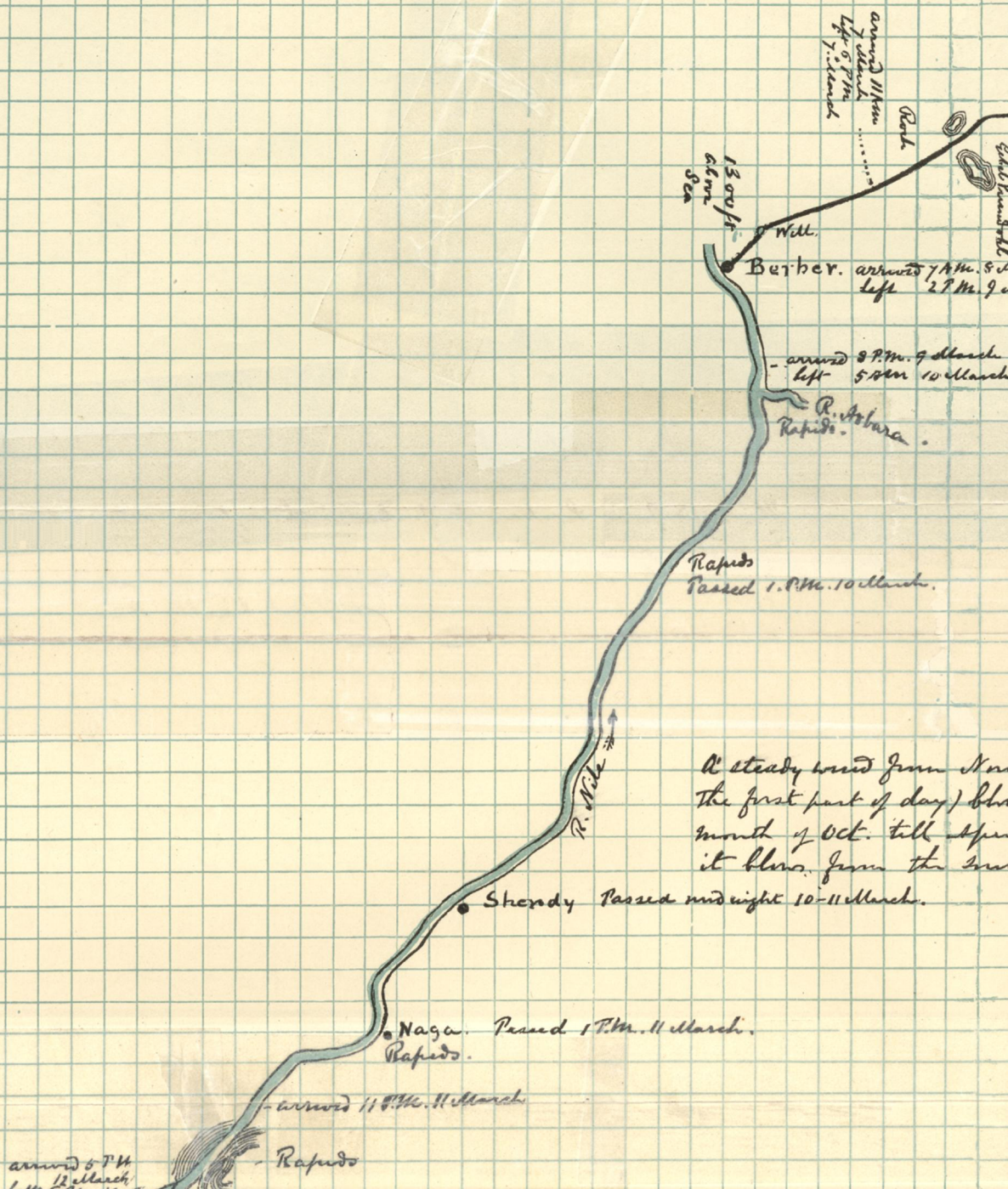
C. P. STONE.

THE ISLAND OF COZUMEL.

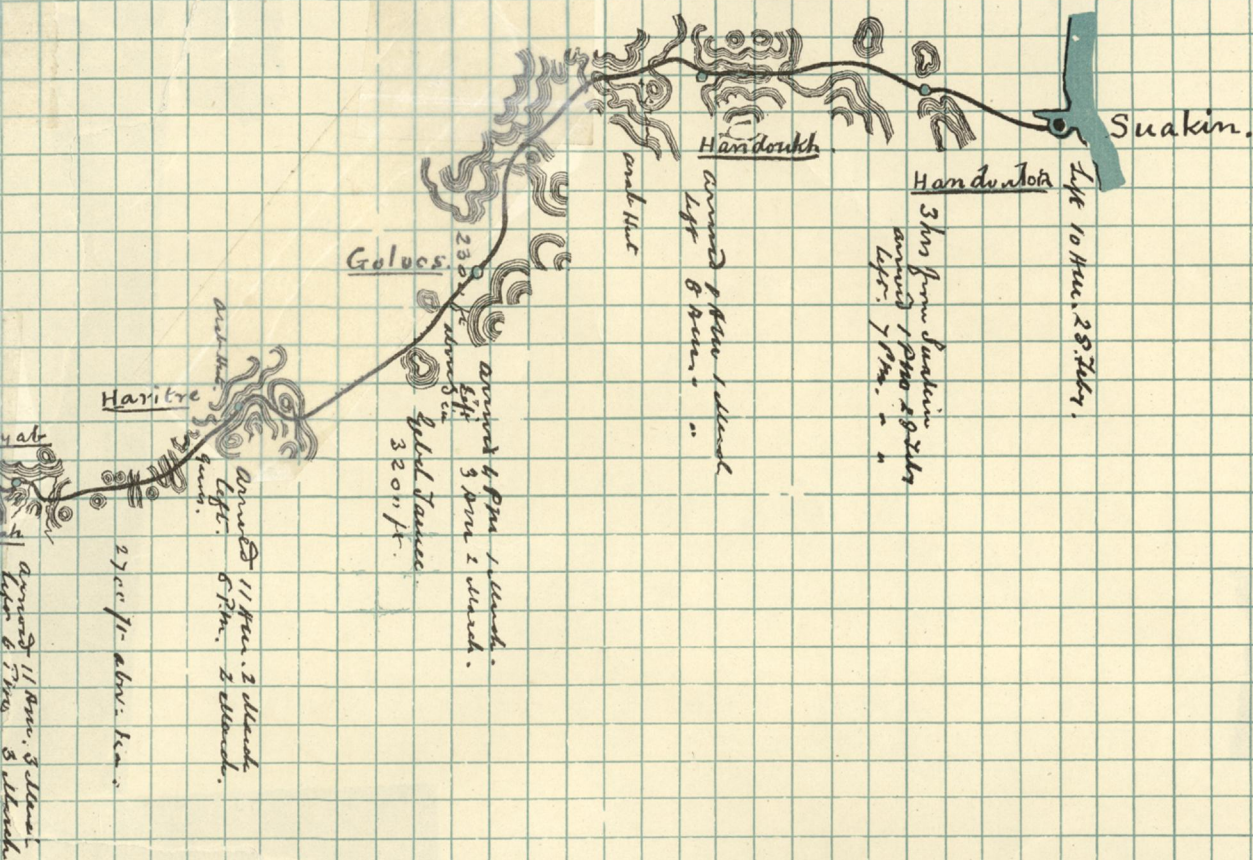
DURING the night of Jan. 22 last, the U.S. fish-commission steamer Albatross was anchored off the northern end of the island of Cozumel, on the east coast of Yucatan, and on the 23d steamed along the western side of the island to an anchorage off the village of



San Miguel, four miles from its north-west end. The naturalists went ashore next day in two divisions, — a shore party and a seining party, the latter aided by men from the ship. Both were remarkably successful, the birds collected

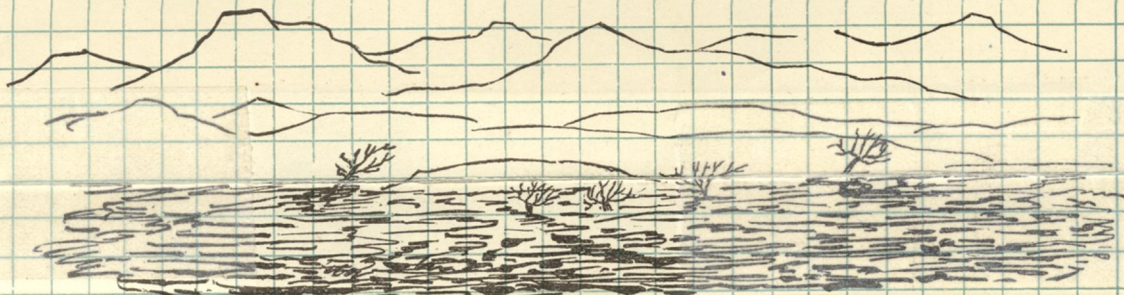


A steady wind from N. (the first part of day) blew from the mouth of Oct. till after it blew from the S. (the second part of day)



Route from Suakin to Khartoum 28 July to 13 March Scale $\frac{1}{425000}$

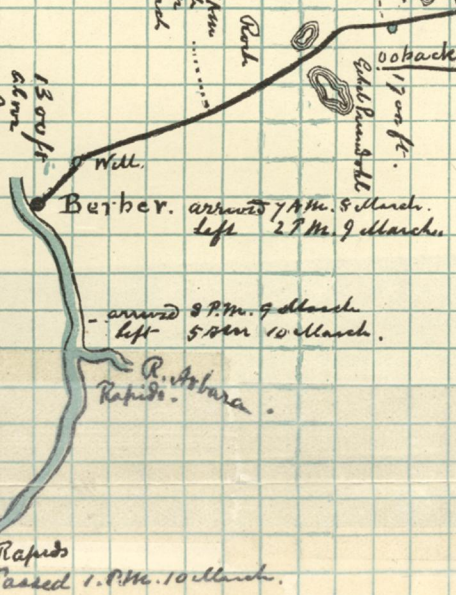
The road from Suakin to Khartoum is through an arid mountainous country, as far as Arab it is sparsely covered with dwarf trees of stunted growth. The wide plains are partly sand, and partly black basaltic stone. From Suakin to Khartoum the plain is generally sandy. The walls are more like scratched in the bed of rivers. During the rainy season, heavy showers fall but they are soon washed up. Pairs of Camel Hires from Suakin to Khartoum 1 1/2 stops. There of Post from Khartoum to Khartoum. 7 or 8 stops. The whole road is dangerous to pass at night. Packages for Camels ought to weigh about 150 or 120 lbs. The climate is very dry. hot during day & cold at night.





The scale of this map is about 1:1325,000 or 21 miles to an inch.

0 5 10 15 20 40 60



2100 ft.

1000 ft.

1700 ft.

Gold Pans etc.

Rock

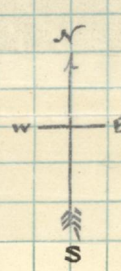
Well

Berber. arrived 7 A.M. 8 March.
left 2 P.M. 9 March.

arrived 8 P.M. 7 March.
left 5 A.M. 10 March.

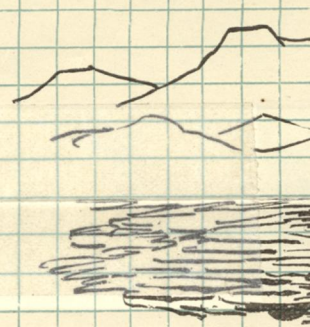
R. Atbara.
Rapids.

Rapids
passed 1 P.M. 10 March.



A steady wind from North (stronger in the first part of day) blows from the mouth of Oct. till April after which it blows from the South from May till Sept. and night 10-11 March.

arch.



NB. The worst part of the road is the 10 miles from Suakin to Berber.

We left Cairo 21 Feb. arrived Suak 21 Feb.
" Suak 22 Feb. " Suakin 26 Feb.
" Suakin 28 Feb. " Berber 8 March
" Berber 9 March " Khartoum 13 March
The vegetation of Berber at Gazala having been burned out in night & the at Khartoum leaving Khartoum on 22 March about the 15 April.

The distance by road from Suakin to Berber about 288 by road. There to be brought in from the South.

March 11 Am. 3 black
March 6 Am. 3 black

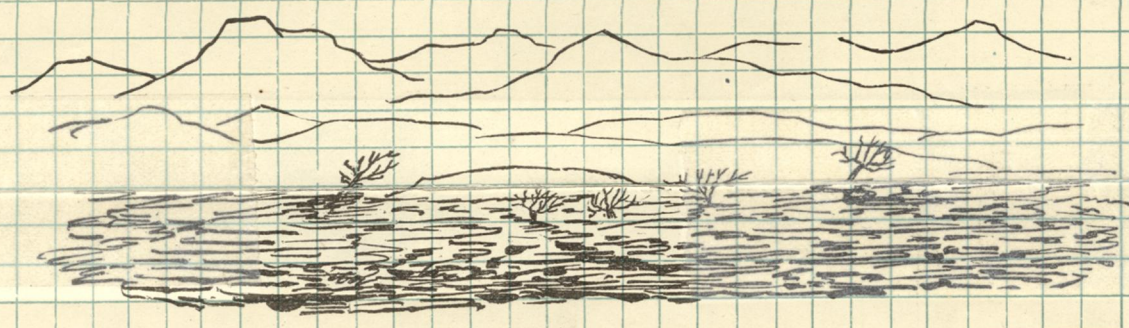
cc 11. abv. 1. a.

11 Am. 2 black
6 Am. 2 black.

March.
March.

Route from Suakin to Khartoum 28 Feb to 13 March Scale $\frac{1}{425000}$

The road from Suakin to Berber is through an arid mountainous country, as far as Arab it is sparsely covered with dwarf trees of stunted growth. The wide plains are partly sand, and partly black basaltic stone from wadis to Berber the plain is generally sandy. The wells are more holes scattered in the bed of rivers during storm, heavy showers fall but they are soon sucked up. Prices of Camel hire from Suakin to Berber 1 1/2 Staps. Hire of Port from Berber to Khartoum. 7 or 8 Staps. The Nile rapids are dangerous to pass at night. Packages for Camels ought to weigh about 150 or 120 lbs. The climate is very dry. hot during day & cold at night.



NB. The worst part of journey between Suakin & Berber is the latter half, the wells being so far apart.

The stations are from Suakin

1. Handoukh	3 hrs	Wetook	1	3 hrs
2. Handoukh	10 hrs	"	2	5 hrs
3. Golvoos	10 hrs	"	3	7 hrs
4. Haritree	10 hrs	"	4	7 hrs
5. Hyab	10 hrs	"	5	9 hrs
6. Mattah	13 hrs	"	6	3 hrs
7. Ariab	16 hrs	"	7	9 hrs
8. Ootack	24 hrs	"	8	23 hrs
9. Berber	24 hrs	"	9	32 hrs

The distance by road from Suakin to Berber about 288 miles by road. There can be brought en route.

Ch. S.

(the only material yet examined) comprising thirteen new species and two new sub-species.

On the 24th the photographer, Mr. N. B. Miller, was sent in the steam-launch to visit the plantation of Mr. J. B. Anduze, in the southern part of the island, some twelve miles away. Mr. Miller's report, which is forwarded with Capt. Tanner's (noticed in No. 113) describes the shores as generally low, with a notable exception occurring at the mouth of a creek, five miles from San Miguel, where the shores are bold enough to allow vessels of

The natives were bright mulatto in complexion, with long, straight, coarse black hair; neater and more intelligent than those of the village of San Miguel. The men were short, not over five feet four inches in height, and wore scanty black beards: the women were neatly dressed in loose white gowns. This village differed from others visited, in its unusual cleanliness, and in the fact that the



INDIAN VILLAGE ON THE ISLAND OF COZUMEL.

cattle were not allowed to run loose, but were penned up within high stone-walled enclosures. Some of

the older Indians knew no Spanish, and all were acquainted with the native dialect.

The small Roman - Catholic church of the village had fallen into ruin because of a curious circumstance. Some remarkable spiritualistic manifestations had taken place there several years ago, and as a consequence the whole village had become a community of spiritualists. It would be interesting to know whether this remarkable conversion was the result of missionary effort, if there be any such among spiritualists, or arose from indigenous 'manifestations.'

On the edge of the village are the ruins of a large structure, supposed to have been a temple, which both Indians and whites declare to date beyond the Spanish conquest. Nothing definite could be learned, beyond the legend that Cortes had landed there and destroyed the building before going to the mainland. The ruins could be traced over about half an acre, now covered by large trees. Only a central tower, or part of it, is now standing. Into this there is but one entrance, opening into a narrow, vaulted room. Markings were noticed on the plaster covering the walls, and stone hooks cemented to the same. Within a radius of half a mile are the ruins of many stone arches,

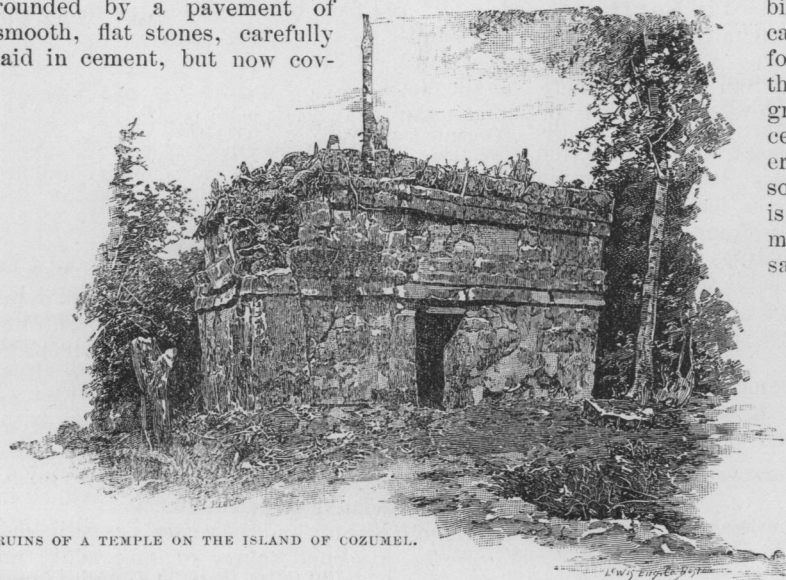
eighty tons to lie alongside to load. His party was landed through the surf on the backs of Indians, and rode to Mr. An-

duze's plantation upon ponies, through a dense forest closed in by interlacing vines so as to shut out the sun, and agreeably remarkable for the absence of buzzing insects. The plantation was about a mile and a half square, enclosed by a high stone wall. It abounded in bananas, plantains, pine-apples, corn, ginger, oranges, and lemons, but seemed to be carelessly or inefficiently cultivated. The main house was stone, with a thatched roof, surrounded by five large sheds arranged in a square.

Near by was a small Indian village of some fifty huts, but only thirty families. The huts were of the ordinary single-room type, with hammocks triced up against the roof in the daytime; the floor of cement, raised about a foot from the ground, and kept scrupulously clean.

as to which the Indians declare that the island was once the cemetery for the neighboring mainland, and therefore will not allow the mounds to be explored.

Subsequently, near the village of San Miguel, Mr. Miller examined and photographed the ruins of an old church, surrounded by a pavement of smooth, flat stones, carefully laid in cement, but now cov-



RUINS OF A TEMPLE ON THE ISLAND OF COZUMEL.

ered with earth. The inhabitants say that this pavement extends for half a mile around the church, and that a broad, paved way once led from the church to the water, a mile away.

ERRORS IN DIGESTION EXPERIMENTS.

HENNEBERG and Stohmann, in their *Beiträge zur rationellen fütterung der wiederkäuer*, published in 1860, reported practically the first determinations of the digestibility of the proximate constituents of cattle-foods. Since that time, a large number of similar determinations upon various fodders, and with the several species of domestic animals, have been made, chiefly, if not entirely, by the German experiment-stations. In these determinations the method employed by Henneberg and Stohmann, and which is here given in outline, has been universally followed.

The food of the animal is weighed, suitable account being taken of any portion left uneaten, and a sample of the food is subjected to chemical analysis. The solid excrement of the animal, which consists for the most part of the undigested portions of the food, is also carefully collected, weighed, and analyzed.

From these data, it is a simple matter to compute how much dry matter or how much of any particular ingredient of the food the animal received, and what part of this failed to be digested.

This method of experiment evidently will give directly the digestibility of any fodder which can be made the exclusive food of the animal. In the case of material like grain, meal, and the concentrated fodders in general, the matter is not quite so simple. In this case it is first necessary to determine the digestibility of a sample of hay, or other coarse fodder. This done, the animal is given a mixture of this coarse fodder and the concentrated fodder in question, and the amount of this mixture which is digested is determined. Then, on the assumption that the same proportion of the coarse fodder was digested in the second trial as

in the first, we calculate how much of the concentrated fodder must have been digested in order to yield the results observed upon the mixture.

Certain sources of error have been ignored in the general statement given above. Thus the excretion is always more or less irregular from day to day; and the excreted matter contains, in addition to undigested food, more or less intestinal mucus, and remnants of digestive juices, which, though small in amount relatively, are not entirely to be neglected. Then it has recently been shown that some portions of the food fail to appear in the excreta, because they suffer a fermentation in the alimentary canal, rather than because they are digested in any proper sense. This is particularly the case with cellulose (see *Science*, No. 100, p. 11). Finally, the methods of analysis in use for fodder and excrement are not in all respects capable of giving sharply defined results.

Another class of errors, the small unavoidable errors of weighing and chemical analysis, usually less considered, may grow to very considerable dimensions when multiplied many

times in computing the composition of large amounts of fodder from that of small samples. In some recent digestion experiments made by the writer at the Wisconsin agricultural experiment-station, a computation was made of the influence of these analytical errors, with results very similar to those arrived at by Kühn¹ in a paper on the effect of cooking and other methods of preparation, upon the digestibility of wheat-bran.

In both cases it was assumed that no material loss of either fodder or excrement had occurred. In view of the care taken in the conduct of the experiments, this assumption seems justified. It at least does not magnify the probable error. It was likewise assumed that the sampling was free from error. In the writer's experiments, analyses of four samples of the same hay agreed so closely as to justify the assumption. In short, the computations were confined to the effect of *analytical errors* upon the results.

With these explanations, we give below a statement of the errors to which the several determinations were found to be subject:—

Probable errors.—Hay.

	Kühn's experiments.	Armsby's experiments.
	<i>Per cent.</i>	<i>Per cent.</i>
Dry matter	—	± 0.08
Organic matter	± 0.1	—
Proteine (N × 6.25)	± 2.1	± 1.15
Crude fibre	± 1.9	± 0.62
Fat (ether extract)	± 2.5	—

It should, perhaps, be added, that the results of a digestion experiment are usually expressed in per cent of the amount fed. The above results mean, that if, for example, 50% of the proteine fed was found to have been digested, the true amount in the writer's experiments was probably not less than 48.85% nor more than 51.15%.

That the probable error appears smaller in the writer's experiments is largely due to the methods of calculation employed. No strict rules can be followed in such a computation, but a considerable field must be left for the exercise of good judgment. Kühn wished to avoid making the error appear too small: the writer, with a somewhat different purpose in view, wished to avoid exaggerating it. It is plain that in both experiments a reasonable degree of accuracy was attained.

Next let us turn to the results upon by-fodders. Here, owing to the method necessarily

employed (see above), the errors are, so to speak, concentrated in the by-fodder, as the following statement shows:—

Probable errors.—By-fodders.

	Kühn's experiments. ¹	Armsby's experiments.	
	Bran.	Malt sprouts.	Cottonseed-meal.
	±	±	±
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Dry matter	—	0.5	0.5
Organic matter	0.6	—	—
Proteine	7.7	2.8	1.6
Crude fibre	7.2	6.8	31.0
Fat	25.6	—	—

¹ Calculated by the writer.

It is evident from these results that determinations of the digestibility of concentrated fodders are subject to a somewhat considerable error. When they contain but little of an ingredient, the relative error may be very large, as in the case of the crude fibre of the cottonseed-meal, while, if the ingredient is present in larger amount, as in the malt sprouts and bran, the relative error is reduced.

In both Kühn's and the writer's experiments, however, a second source of uncertainty was discovered in the fact that the same animal may digest the same fodder to a somewhat different extent at different times. The writer's experiments show one unmistakable example of this, and Kühn's several.

Now, as stated above, the calculation of the digestibility of a concentrated fodder is based on the assumption of unaltered digestibility of the coarse fodder. If this assumption is not true, the whole of the error thus introduced will, by the method of computation employed, attach to the concentrated fodder. The following statement shows what very considerable errors may arise from this source, combined with the analytical errors above noted:—

Possible errors.

	Kühn's experiments.	Armsby's experiments.	
	Bran.	Malt sprouts.	Cottonseed-meal.
	±	±	±
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Dry matter	11.5	4.3	4.7
Organic matter	9.6	—	—
Proteine	15.4	5.7	3.2
Crude fibre	91.5	10.9	52.4
Fat	36.1	—	—

¹ Lande, versuchs-stationen, xxix. 1.

The experiments which we have been considering compare favorably as to methods and care with previous experiments of the same sort; and it does not seem unwarranted to conclude that those, also, are subject to errors of somewhat the same magnitude. It appears plain that we can, with proper care, determine the digestibility of the total ration fed with a very satisfactory degree of accuracy; but it seems equally plain that we cannot compute from that result the digestibility of any single fodder composing the ration with the hope of obtaining any thing more than approximately correct figures. The data which we have for the digestibility of the concentrated fodders are of more or less value for practical purposes, since they are usually the average of several determinations; but for scientific purposes such determinations are of very doubtful value.

H. P. ARMSBY.

AN ANTHROPOMETRIC LABORATORY.

In the February number of the *Journal of the Anthropological Institute of Great Britain and Ireland*, Mr. Francis Galton describes the laboratory which he established at the International health exhibition to familiarize the public with simple methods of measuring and recording many of the physical characteristics of man. The instruments in action dealt with keenness of sight, color-sense, judgment of eye, hearing, highest audible note, breathing-power, strength of pull and squeeze, swiftness of blow, span of arms, height standing and sitting, and weight. Some other apparatus not in actual use, such as a balance to determine delicacy of touch, was exhibited.

All these instruments were so contrived as to economize the time of the attendant; so that, although each person measured was in the laboratory about twenty minutes, he consumed but seven minutes of the attendant's time. Thus it was possible to measure ninety persons daily, and cover the running expenses of the laboratory with a tax of threepence each. Of course, the reduction of expense to a minimum gives a much broader field for work, especially in introducing periodic systematic measurements into schools, which is one of the ultimate objects of this demonstration.

Keenness of sight, or power of accommodation of the eye, was measured by means of an original instrument of a flat, sickle-shape, upon which were set upright, at regular intervals, small blocks of wood, covered below with printing in diamond type, and having printed at the top in large type the distance in inches from the eye-piece. The number of inches at which the diamond-type is legible is an expression of the accommodating power. This test showed, that, of 850 persons, forty per cent had both eyes equally effective, while sixty per cent had a notable

difference in the power of the two eyes. The average difference between the two eyes was two inches; but the average strength of the right and left eye was almost exactly the same. The color-test was Holmgren's light-green test, nicely arranged to economize time. Judgment of the eye in dividing a line into halves, and in setting a movable arm square upon a board, were tested in ingenious ways, which doubtless among children would express the native quality, but oftentimes among adults would be only a measure of facility acquired by occupation. The highest audible note was measured by five whistles, set to emit 10,000, 20,000, 30,000, 40,000, and 50,000 vibrations per second respectively. Of 317 males between forty and fifty years of age, a hundred per cent heard the first whistle, to four per cent who heard the last. In this, as in every other particular, the males excel the females.

The spirometer used consists of a counterpoised vessel suspended in water, which rises as air is breathed into it, and shows the number of cubic inches of displacement by a scale at its side. The breathing-capacity increases rapidly in early youth, becomes stationary between twenty and thirty, or a little later, and thenceforward steadily declines. Up to the age of twenty, the breathing-capacity has been the same for both sexes; but at that age that of the males becomes half as great again, — a ratio which is maintained throughout after-life. Unexpectedly, it appears that there is no close relation between the breathing-capacity and the strength of pull or of squeeze. The latter, which were estimated by means of Salter's instruments for the purpose, show that the left hand is about six per cent weaker than the right, and that women are weaker than men. Of the 1,657 adult women measured at the laboratory, the strongest could exert a strength of squeeze of but eighty-six pounds, or about that of an average man.

For the first time, swiftness of blow was measured, either of a blow delivered with the fist straight at a pad upon one end of a flat bar running freely between guides, or of a pull, by holding a stirrup attached by a string to a similar bar, and striking out into space. The swiftness is registered by means of a spring with pencil attached, which is set free, and vibrates transversely as soon as the bar begins to move. The results of this measurement are not discussed.

A curious fact, which came to light on comparing the height sitting with the height standing, is, that in women an increase in stature is accompanied by a disproportionate increase in the length of the legs, while in men, for all statures up to six feet, the ratio between height sitting and height standing is the same, 54:100.

During the continuance of the laboratory, 9,337 persons were measured, of whom 4,726 were adult males, and 1,657 were adult females. The results of all these measurements are not fully discussed, nor has Mr. Galton perfected his ideal of a laboratory. Among other measurements which will be added to the list, are those of the head, its maximum length and breadth with graduated calipers, and its maxi-

mum height above the plane which passes through the upper edges of the orbits and the orifices of the ears. Mr. Galton adds, that while writing his account, instruments for head measurements were being solidly constructed for him, which will be in use in Cambridge, Eng., in 1885.

THE STATUS OF AERONAUTICS IN 1884.

DUROY DE BRUIGNAC, member of the French Société des ingénieurs civils, has recently presented to that association a very complete yet concise *exposé* of the present state of the art of aeronautics, especially as related to the general system of 'dirigible' aerostats. The first indications of success are assumed to have been given by the experiments of Giffard (1852-55), Dupuy de Lôme (1871), and Tissandier and Renard and Krebs (recently). The first condition is considered to be stability, retaining the relative position of parts seen in the earlier balloons.

Giffard, in his earliest attempts, attained a speed of three, and later of four, metres per second. Dupuy de Lôme, and Renard and Krebs, have used better forms of balloon, and have secured more rigidity of structure; but none have obtained high speed.

Extreme lightness of motor is a vitally essential feature; and the best that has yet been done is illustrated by the steam-engines of Thornycroft, weighing about 33 kilograms (73 pounds) per horsepower, and which, by sacrificing economy of fuel, it is thought possible may be reduced to 20 kilos (44 pounds), and the various storage and other batteries yielding electricity, which, according to Tissandier, may be reduced to a weight not exceeding 25 kilos (55 pounds) per horse-power. Messrs. Renard and Krebs claim a weight as low as 17 or 19 kilos. The experiment of Tissandier in 1883, in the application of electricity to this work, is thus expected to lead to useful results.

The propelling instrument is always the screw. Its position is a matter of importance. As usually arranged, it has a tendency to cause vertical deviations of the machine, which are objectionable. It is hoped that it may prove possible to place the screw-shaft in line with the axis of symmetry of the balloon, in order to avoid this difficulty. This may be done by setting it between a pair of spindle-shaped supporting balloons. It is uncertain whether it will be found best to place it ahead or astern of the balloon; but it is presumed best at the stern. The screw is objectionable on the score of its low efficiency,—about 0.30 (?); but nothing better has yet been devised.

Bruignac proposes a formula by means of which to calculate the resistance of the aerostat, and by its application determines the relative resistances of the machines of the several aeronauts whose work has been mentioned, as follows: Giffard, 1852, 0.076; Giffard, 1855, 0.035; Dupuy de Lôme, 0.18; Tissandier, 0.12; Renard and Krebs (1), 0.12; Renard and Krebs (2), 0.02. In the last two cases, the large and

the small ends of the vessel are calculated separately.

The speeds actually obtained by them were 5.5 metres per second by the last named, and from 3 to 4 metres by their predecessors. Had the former driven their machines with the small end ahead, instead of the larger end, as actually practised, the critic calculates that they might have obtained a speed of nearly ten metres. A symmetrically formed cylindrical spindle is advised as the probably best form for the body of the air-ship, inserting a straight middle body when constructing very large vessels. The larger the machine, the lighter, comparatively, will be the driving machinery. The substitution of supporting hoods, sheets, or tissues, for cords, may assist in the endeavor to reduce resistances. The loss of gas by leakage can be reduced by choice of proper material for the balloon. The waste of gas in ascending and descending must be avoided, and may, perhaps, be obviated altogether. This becomes an easier matter in ascents of the kind here contemplated, in which no greater height will be sought than is sufficient to clear obstacles safely: probably a hundred metres will prove ample. For such work, the alternate compression and expansion of the adjusting volume of gas will probably suffice.

The conclusion is reached that the art of aerostation is much nearer a practically applicable state than scientific men generally suppose. The objects now sought are the attainment of better and more stable forms, the more effective arrangement of parts, the invention of lighter motors, invariable in weight, and convenient of operation, and the securing of higher efficiency of propelling instrument. Even now, with the experience of the past, it is possible to build a machine of this class capable of making at least ten metres per second through the surrounding medium.

These conclusions of Bruignac are especially interesting when compared with those of Pole as presented to the British institution of civil engineers, in which he finds that the supporting-power of the balloons adopted by the aeronauts above mentioned, and the driving-power and weights of the torpedo-boat engines of British makers, are such as should permit the construction of an air-ship four hundred feet long, to travel at the rate of thirty miles an hour.

R. H. THURSTON.

FINDING A BORE-HOLE.

Two novel and ingenious methods of locating the position of a bore-hole have recently been described in the London *Engineering*. In the first case, at Edinburgh, it was desired to connect the lower end of a bore-hole, two hundred feet deep, with a well some eighteen feet distant. A drift run in the supposed direction failed to strike the hole, although much rock was cut away, and it was evident that the drill had deviated considerably from the vertical. After an unsuccessful attempt to locate its direction

by the sound arising from shaking rods within it, Mr. Andrew Haddow, the engineer, lowered four eight-inch bar-magnets (placed end to end, with the south pole down) into the bore. The north pole of a compass-needle in the mine moved first to the west, and then to the east, of magnetic north, as the magnets were lowered, indicating that the magnets were to the westward of the compass. While the heading was being enlarged in this direction, Mr. Haddow experimented by passing a magnet around the compass, and drawing a series of curves for positions of the magnet, which produced different angular deflections of the needle. The compass was then placed successively at two different points in the heading, and the deflections caused by the magnets in the bore-hole were noted, — at one point $3\frac{3}{4}^{\circ}$, at the other $6\frac{1}{2}^{\circ}$. The two points were then marked on the plan of the mine, a tracing of the magnetic curves just referred to was placed over each point, and the intersection of the curves corresponding to these deflections was noted. Upon excavating to the point thus indicated, the bore was found, being about eight feet from the true vertical.

In a second case, in Australia, the diamond drill, in going down three hundred and seventy feet, had deviated beyond sensible magnetic influence, and the search by underground mining was continued for nearly twelve months without success. Mr. E. F. Macgeorge then employed glass phials partly filled with melted gelatine, and having a compass-needle in a lower connected bulb of the phial. When these were carefully lowered in the bore to different depths, and the gelatine congealed, the needle would become fixed in the magnetic north, and the surface of the gelatine would be horizontal. These two indications, when the phial was withdrawn, showed the inclination and magnetic bearing of the bore-hole at that point; and a sufficient number of observations at convenient depths permitted the erratic bore-hole to be completely mapped from top to bottom. This map showed a deviation of nearly forty feet at three hundred and seventy feet down (the point so long searched for), and of between seventy and eighty feet at the full depth of five hundred feet. A drift straight for the indicated spot found the lost bore thirty-seven feet and a half away from its proper place, and the bottom was found seventy-five feet astray. This device has since been perfected and patented.

FISHING-INTERESTS IN HUDSON BAY.

THE chief commercial value of this district undoubtedly lies in its immense fishing-interests, if we include in that term whaling and sealing.

American whaling-vessels have for more than a quarter of a century been conducting a very profitable fishery in Roe's Welcome, a large basin in the north-western portion of Hudson Bay. The vessels usually leave New England in July, and reach Marble Island in September, where they winter, one or two every season, and occasionally more. Sawing out of the ice in the following June, and pressing northward

as fast as the ice will permit, they fish until about the first of September, unless sooner loaded, and then sail for home. During the eleven years preceding 1874, about fifty voyages are known to have been made; and the returns give an average of \$27,420 per voyage, which shows a large margin of profit to the small sailing-vessels usually engaged in the trade. It is estimated that the aggregate value of oil and whalebone already obtained is about two and a quarter million dollars, and every thing points to a large extension of the industry.

The porpoise-fishery is extensively carried on by the Hudson-Bay company; the fish, as they are popularly called, being held in check by means of trap-nets on flats in coves where the tide rises ten or fifteen feet, and left high and dry when the water recedes. Last year the company secured nearly two hundred in one tide at Churchill, and a much larger number at Ungava Bay. The blubber weighs from two hundred and fifty to four hundred pounds, and is very rich in the finest of oil. Formerly the blubber was exported; but the company has established extensive refineries at several of its northern stations, and now ships the oil in casks.

The company also carries on a walrus-hunt, sending two sloops annually from Churchill to two very productive walrus-grounds north of Marble Island, where they have never failed to obtain full cargoes of blubber, ivory, and hides in a few weeks, besides carrying on a valuable trade in oil, ivory, musk-ox, and other skins, with the northern Eskimo.

During the exploring-steamers *Neptune's* visit to Stupart's Bay, the Eskimo were living on the harp-seal (*Phoca groenlandica* Linné), and had in their possession skins of a good many harbor and square-flipper seals (*Phoca vitulina* Linné, and *Erignathus barbatus* Fabricius), seals of all kinds being abundant.

The Hudson-Bay company has a steamer, the *Diana*, plying between London and Ungava Bay direct, fitted up with refrigerating apparatus, and engaged solely in conveying salmon fresh to the London market. Last year's cargo is reported to have realized eighteen thousand dollars. Nearly every stream contains both salmon and trout in vast quantities, chiefly where the salt and fresh waters mingle.

Cod abound in the vicinity of Chudleigh, though not up to the present time found in Hudson Bay. Newfoundland schooners even now work as far north as Nachvak, and seem to be going farther each year. The cod, though good, are not equal to those of the Banks. While the *Neptune* was at Port Burwell, both in going and on returning, the anchorage teemed with cod, which were taken in great numbers by jigging from the ship's deck.

THE DRAINAGE SYSTEM OF BRAZIL.¹

THE hydrographic features of Brazil are to a certain extent determined by the orographic system, and by the distribution of mountains and plains described

¹ From the *Rio News*.

in *Science*, No. 112. They are, however, still more dependent on the general structure of South America; since almost all of the great Brazilian rivers belong to hydrographic systems which interest other parts of the continent outside of the Brazilian plateau.

South America is made up of three great masses of highlands, in great part mountainous, more or less completely separated by depressed areas, in which flow the great rivers Amazonas, Orinoco, and Paraguay; the latter, rather than the Paraná, being taken as the dominant feature of the La Plata system.¹ These masses of highlands are, the long and narrow Andean plateau, the Brazilian plateau, and the plateau of Guiana. The Andean plateau, being very near the Pacific coast, throws nearly all the drainage of the continent eastwards to the Atlantic; while the plateaus of Brazil and Guiana force the waters to flow northward to the Caribbean Sea, southward to the South Atlantic, or eastward through the central basin, or great Amazonian depression which separates them. Thus the Paraguay has a southerly course in the centre of the great depression between the Andean highlands and those of Brazil, receiving a considerable part of the drainage of both; the Orinoco bears the same relation to the highlands of the Andes and of Guiana, which give a northerly course to the drainage; while the vaster Amazonas has relations with all three of the continental plateaus, rising in the Andes, and flowing between the highlands of Brazil and of Guiana, receiving tribute from both of them, while by means of its great tributaries, the Madeira, Rio Negro, and others above them, it includes in its basin a considerable portion of the great depression between the Andes and the two detached eastern plateaus of the continent.

With few exceptions, all the great rivers of South America belong to one or the other of these basins, which may be called continental, because they pertain to more than one of the great component parts of the continent. The other rivers belong to one or another of the three plateaus; and of these, those of Brazil are the largest and most important, because the Brazilian plateau is larger than that of Guiana, and better watered than the part of the Andes that drains into the central depressions. Considering the Uruguay as belonging to the La Plata system, the exclusively Brazilian rivers (in a geographical sense) are those that flow from the eastern watershed of the plateau directly to the Atlantic. If, however, not only those that have their course in the country, but also those that commence or terminate in it, are considered as Brazilian, the rivers group themselves naturally into three great divisions; viz., those that flow directly to the Atlantic, and those that form part of the Amazonian and Platine systems.

The great watershed of the empire, that which separates the indirect from the direct Atlantic drainage, is determined by the orographic features already described. It does not, however, follow continuously the culminating orographic lines, but rather passes from one to another of these lines by means of the transverse ridges which unite them. Thus in

the south the Atlantic-Paraná divide is formed by the culminating ridges of the southern part of the Serra do Mar; in the central portion the Paraná-São Francisco divide is formed by the Serra da Canastra, or Matta da Corda, in western Minas, and by the transverse ridges which unite this chain with the Mantiqueira branch of the Serra do Mar, and with the mountains of Goyaz; in the northern portion of the great watershed the divide is formed by the extensive ridge, which, branching off from the Goyaz Mountains, accompanies all the course of the Tocantins, — a ridge whose true orographic character is, as stated in a previous article, very imperfectly known.

The secondary watershed, which divides the waters of the Amazonas from those of the La Plata system, is well defined and regular in the part between the Araguaya-Tocantins and the Paraná, being formed by the mountains of southern Goyaz, which extend from south-west to north-east; but farther west, between the Paraguay on the one side, and the Xingú, Tapajós, and Guaporé, of the Amazonian system, on the other, the divide is near the irregular jagged margin of the Amazonian tableland, and is not marked by any notable elevation of the surface; and the passage from one system to the other is comparatively easy. Thus in the detached Serra do Aguapehy, which seems to be an outlier of the southern margin of the tableland, rise the Rio Alegre — one of the head waters of the Guaporé — and the Aguapehy, which, through the Jaurú, discharges into the Paraguay. In the lower lands at the base of the serra, and after both these streams have become navigable for small craft, they flow for a certain distance near together; and the intervening land affords two practicable portages of the extension of 8,640 metres and 11,708 metres respectively, over which boats have been passed from the waters of the Paraguay to those of the Amazonas, or *vice versa*. In 1773 an attempt was made to open a canal across the shortest of these portages, which, like the Cassiquiari, should serve to unite two great basins, and afford uninterrupted fluvial communication from the mouth of the La Plata to that of the Orinoco. The attempt was, however, abandoned; and accurate levelling will probably show that the project is impracticable. There are also two practicable portages between the affluents of the upper Tapajós and the Cuyabá, a tributary of the Paraguay. One of these is only 1,285 metres wide; and canoes with cargoes of Amazonian products have frequently been transported to the waters of the Paraguay. As in this region the Tapajós flows at a much higher level than the Cuyabá (at least, in its navigable portion), the difference of level to be overcome is probably much greater than in the case of the Alegre and Aguapehy.

In consequence of the disposition of the highlands and lowlands above indicated, there is a great difference between the rivers of these two divisions, which is of capital importance with reference to the internal communications of the empire. The Amazonas and Paraguay, being pre-eminently rivers of the depressions (the first descends to a level of less than 10) metres very near to the foot of the Andes, and the

¹ See the map on p. 274.

latter flows at an elevation of only 123 metres at Cuyabá near its source), afford uninterrupted navigation for almost their entire course. The tributaries of these two rivers, and the other Brazilian rivers in general, are, however, plateau streams, and have two navigable portions, — one on the upper stream on the plateau; and the other in the depression, or coast border region. The difference of level between these two portions is one or more hundred metres, and the descent has to be accomplished by a series of cataracts situated at a relatively short distance above the mouth of the river. Of these, the most notable are the Paulo Affonso cataract on the São Francisco, and the Sete Quedas ('seven falls') on the Paraná. The upper tributaries of the Amazonas, between the foot of the Andes and the Rio Negro on the north, and the Madeira on the south, are exceptions to this rule; since they descend from the plateau on which they rise in their upper courses, and afford long lines of navigation. They thus reveal the interesting fact that a vast area of the almost unknown upper Amazonian region is at a much lower level than the adjacent plateaus. Of the rivers that flow directly to the Atlantic, those of the province of Maranhão and the Parnahyba, in Piauí, offer the greatest facilities for navigation; because they rise at a lower level than the rivers to the southward, and effect their descent to the sea-level by a gradual slope distributed along the whole course, instead of being concentrated in one or more grand series of rapids.

The Amazonas and Paraguay present peculiar features in the very extensive alluvial plains that border the main river and the lower courses of their tributaries, and in the great number of anastomosing lateral channels that cut these plains and put the main river in communication with the tributaries, often at long distances above the junction, and these last with each other. These canals are particularly notable in the case of the Amazonas, where they are called *paranamirins*, or *furos*;¹ and it is said that a boat may traverse almost the entire length of the Amazonas valley without entering the main stream. The formation of these canals is to be attributed in part to the formation of alluvial islands that are constantly being created by the sediment-loaded waters of the great river. The number and character of many of them, and especially of the *furos*, seem, however, to indicate a more general cause, and suggest the idea, that, since a relatively slight depression of the surface would transform the river-valley into an estuary, it may reasonably be supposed that at some time a correspondingly slight elevation has transformed an estuary into a river-valley. The long distance to which the influence of the tide (it is sensible at Obydos five hundred miles above the mouth of the Amazonas) is felt, gives an air of probability to this hypothesis. In this case the present tributaries would have been independent rivers, and would naturally have had deltas, the canals of which would in part become closed, and in part be transformed into *furos*, when the estuary was changed into a river.

¹ The former are canals that return to the same river from which they parted; the latter, those that unite two distinct rivers.

The *paranamirins* would in this hypothesis represent the marine channels of the muddy bottom of the estuary. It is certain that the lower portion of the Amazonas valley still presents so much of the character of an estuary, that a question has arisen among geographers as to whether the Tocantins should be considered as a tributary, or an independent river. The fact that it receives a considerable quantity of water from the Amazonas through various *furos* decides the question of its being a tributary, since the Amazonas contributes much more water than the Tocantins to the so-called Pará River, which is only the southern branch of the great Amazonian estuary.

Attention has often been called to the curious fact, that, unlike most large sediment-loaded rivers, the Amazonas has no delta. The reason appears to be, that its lower course is still in a transition state between the estuary and fluvial conditions; and the delta is not to be looked for at what is generally considered as the mouth of the river, but higher up at the head of the estuary. In this case the network of canals between the mouth of the Xingú and the western end of the island of Marajó may be considered as the true delta.

In a certain sense, the La Plata basin is a triple one, since a slight change of level, which should take the head of the estuary to the mouth of the Paraná, would effect the separation of the Paraguay, Paraná, and Uruguay as three distinct basins. Although smaller than the Paraná, the Paraguay should be considered as the main stream on account of its relations with the elevated portions of the continent to the east and west. The Paraná, as already stated, is essentially a highland river. Its tributaries flow into it before it enters the depression by the great cataract of Sete Quedas. The only exception is the Iguassú, which has its great cataract of Santa Maria close to the junction. A peculiarity of the Paraná is that the eastern margin of its basin is so close to the Atlantic, that one of its tributaries, the Tieté, may be said to rise in sight of the sea. Another peculiar feature is the tendency of its eastern tributaries, especially marked in the case of the Tieté, to flow in a north-westerly direction, as if they were seeking the source, rather than the mouth, of the main river. This indicates a general north-westerly slope in this part of the plateau.

A few peculiarities in the principal rivers of the direct Atlantic drainage system, which indicate interesting points in the topographical structure of the country, may be mentioned here. Such a point is the general parallelism of the São Francisco to the coastline in the greater part of its course, due to the river being confined behind the Serra do Espinhaço, which, terminating to the northward, finally permits the river to escape, and direct its course toward the sea, making a right angle to its former course. The same phenomenon is presented in a still more interesting manner by the Parnahyba, which exhibits a double parallelism, the river making a U-curve in the upper part of its course, and, after a course of about two hundred miles, passing close by its source. This is due to a

subordinate member of the Serra do Mar system (the Serra da Bocaina, or Quebra Cangalha), which, being intercalated between the maritime range and the Serra da Mantiqueira, impels the river to the south, until, escaping around the end of this barrier, it encounters another in the Mantiqueira, which forces it northward until it finds a passage across the Serra do Mar, and escapes to the sea. The Iguape, or Ribeira, in southern São Paulo, with its northern tributary the Juquía, reveals the same fact of the splitting-up of the maritime range into distinct ridges.

O. A. DERBY.

IRVING ON THE COPPER-BEARING ROCKS OF LAKE SUPERIOR.

IN his opening chapter, Professor Irving gives a succinct history of the earlier investigations of the copper-bearing rocks of Lake Superior, a clear exposition of the views that have been held respecting them, and a full bibliography of his subject. The discussion proper is introduced by a sketch of the extent and leading characters of the formation, illustrated by an excellent map. This is the first really synoptical view of the series, in any thing like its regional entirety, that has been presented.

Instead of a mere local phase of some well-known geological horizon, it is described as a unique formation of consistent characters and enormous thickness, stretching out to an ascertained length of five hundred miles, with a width of a hundred miles, and an area, excluding the Nipigon extension in Canada, of forty-one thousand square miles, — nearly two-thirds the size of New England. "Throughout this wide extent, though local peculiarities are to be noted, the general characteristics of the group are wonderfully constant." It consists of an enormous series of eruptive sheets, — lava overflows in the main, — among which are intercalated beds of sandstones and conglomerates, and over which lies a great thickness (fifteen thousand feet) of detrital material, making a total pile of forty thousand feet.

A careful description of these rocks next follows, illustrated by very fine microscopic sections, and conveniently summarized in tables. The studies of Professor Irving do not add greatly to the kinds of basic rock previously described by Professor Pumpelly in the reports of Michigan and Wisconsin; viz., diabases, malaphyrs, and gabbros. He has, however, amplified the varieties and the geographical distribution of these, and added an

interesting anorthite rock. To the acid eruptives he has made a more notable contribution in determining not only the presence, which was partially known before, but the important development of quartzless porphyries, quartziferous porphyries, felsites, augite syenites, granitells, and granites. He shows that these are, at the same time, members of the original eruptives, and chief contributors to the detrital beds, especially the conglomerates. But more completely new and theoretically important is the recognition of a class of intermediate rocks (silica from fifty-two to sixty per cent) which constitute phases of the orthoclase, uraltic, and hornblende gabbros, and of the diabases, diabase porphyries, and their amygdaloidal forms. The detrital rocks are conglomerates and sandstones, with shaly phases. They are chiefly derived from the acid eruptives, though where closely associated with basic rocks, a large element is derived from these. In some parts a notable contribution has been made by the older crystalline rocks.

The lithological discussions are critical, and evince a familiarity with the latest phases of this rapidly developing branch of study. They embrace a hundred and eighteen pages.

Following this are nearly two hundred pages devoted to the stratigraphy of the series. The author maintains with justness, that the igneous beds, being overflow sheets, are fully amenable to the common laws of stratigraphy; and his discussion is notably free from the license of eruptive geology. He brings together for the first time, from his own and others' observations, specific descriptions of the formation from all sides of the Lake-Superior basin. It is to be hoped that in this he inaugurates a new era in the discussion of Lake-Superior geology, in which the study of its problems shall be cosmopolitan, in distinction from that narrow provincialism or that distant unfamiliarity which has so largely vexed their past history. Professor Irving's descriptions necessarily fall much short of full completeness; but they constitute a great advance in the endeavor to give, by precise descriptions, maps, and sections, an approximately accurate conception of the entire formation, so far as displayed in the Superior region. Completeness will only be approached when it is possible to extend over the whole region such excellent detail work as that of Pumpelly and Marvin in Michigan, and the author himself in Wisconsin.

The eighth chapter of the monograph is devoted to the relations of the Keweenaw series to the associated formations, and traverses the ground which has been most contested in Lake-

Superior geology. To the class of formations later than the Keweenaw, he refers the fossiliferous Cambrian sandstone of the Mississippi valley, and the horizontal sandstones of the Superior basin, known in local geology as the 'eastern' and 'western' sandstones. To the series of older formations he refers the Animikie group, the original Huronian, and the Penoque, Marquette, and Menominee Huronian groups. The fossiliferous sandstone of the Mississippi valley (Potsdam) he confidently considers later than the Keweenaw series, because it unconformably overlies it, with evidence of great intervening erosion. The 'eastern' and 'western' sandstones also are held to be newer, because they adjoin the Keweenaw series by unconformable contacts associated with fault-lines. These three sandstones he refers to essentially the same horizon, — the Potsdam, or its immediate downward continuation. In support of these views, he cites a large array of specific evidence, and gives precision to his discussion by maps and diagrams. The older formations named are separated from the Keweenaw on the grounds of unconformable relations, and discordance of character.

The stratigraphical discussion is fittingly closed by a sketch of the Lake-Superior synclinal. The existence of a downward flexure embracing the western part of the basin was long since made known by Foster and Whitney. Professor Irving and his Wisconsin colleagues, a few years since, determined its south-westerly extension into the borders of the Mississippi basin. The author now makes an important extension eastward so as to embrace nearly all of the lake's area, the trough assuming a curved, rudely reniform contour.

The monograph is closed by a chapter on the copper deposits, which were, however, not special subjects of investigation.

The treatment throughout is candid and able. There is a close adherence to facts, and the conclusions that legitimately flow from them. The memoir is a valuable contribution to general geology. The horizon of which it treats has long lain under a cloud of obscurity, if not of actual chaos, in Europe as well as in America. The distinct differentiation of the formations of one important field cannot fail to aid in the study of all others. When equally explicit descriptions of other regions involving this horizon shall be at command, we shall doubtless be on the threshold of agreement as to its taxonomic place and value. Present disagreement is largely an expression of imperfect knowledge and provincial study.

WORLD-STUFF.

'WHENCE came this world?' and 'Whither is it going?' are questions of never-tiring interest to mankind, — questions upon which they have pondered for long ages, and which are still unsolved. Where is the man who, without a shudder, can turn from the beautiful life around him, and in fancy contemplate a cold, cheerless, dark, lifeless condition of the world towards which we have every reason to believe it is tending?

In the book before us we have an effort made to weave the various speculations of others, regarding the evolution of the universe, into a continuous and harmonious whole by an admixture of the author's own ideas. Professor Winchell is well known from his past efforts to popularize science, and for his speculative tendencies; and perhaps he, of all American writers, is best fitted to popularize a subject like the one he has chosen, and commend it to the interest and attention of the masses. The work is to be judged rather by its success or failure as a popular presentation of the subject, than as an original contribution to cosmical science. In either respect, the book is disappointing; for our author, instead of keeping in a field in which he has perhaps no superior in America, has attempted a middle ground. He has written so that his treatise occupies a higher plane as a scientific treatise than his previous books, although, as is the tendency of all speculative minds, the presentation of theories has been mistaken for the presentation of evidence and proof. Again: as a popular presentation of the subject, the work falls below the other books of the author, so far as we are acquainted with them, and doubtless many portions will be considered by its readers as dry and pedantic. On the other hand, the work shows in many parts a mode of presentation of certain difficult questions that is well worthy the careful study of the majority of our scientific writers who have any desire that their readers should understand what they are writing about.

The author holds that the dust and iron globules found in the depths of the sea and on the mountain-tops are of meteoric origin, — a veritable world-stuff, pervading all space, — and that by and from this stuff world-systems are evolved. He supposes that a tendency for immense amounts of these dust particles to associate about a common centre leads to the formation of nebulous clouds, which, from a

World-life; or, Comparative geology. By ALEXANDER WINCHELL, LL.D., professor of geology and paleontology in the University of Michigan. Chicago, Griggs, 1883. 21+642 p. 12°.

drawing-together of the scattered particles, become heated, according to the well-known law for gases.

It will not do, perhaps, to be critical here, any more than one should be of a fairy-tale, for it would destroy the charm of the illusion; and there is no reason why this speculation is not as good as, or perhaps better than, any other cosmological theory.

The book, further, contains an additional part, giving a historical account of the evolution of cosmogonic doctrines; while, as a whole, it contains very full references to the literature of the subjects discussed.

HOVEY'S MIND-READING.

THE title of this book gives no adequate idea of its contents. It is a very full account, indeed in great part a reprint, of such of the Proceedings of the English Society for psychical research as refer to thought-transference, with a few pages of introductory and concluding matter. Why this fact should not be made apparent in the title, we fail to see, as it is distinctly stated in the body of the work, and is evident on every page. The title will naturally suggest to the reader an original discussion of the history or philosophy of the subject, which the book does not pretend to give him. None the less, however, must we thank the author for presenting to the American reader so complete an account of what is really important and interesting in the volumes issued by the society referred to. He has wisely omitted every thing not pertaining to the special subject of mind-reading and telepathy. The matter pertaining to this subject is presented so fully and so faithfully, that it leaves little for the reviewer to say of the general character of the contents of the book.

What are really original, are the author's own discussions in the first and last chapters. These discussions are, we regret to say, of a nature rather to cast discredit upon the whole subject, in the minds of the closest thinkers, than to throw light upon it. The author wholly mistakes the point at issue between the believers and unbelievers in psychic force. He joins the great army of hobby-riders by holding up to ridicule or disapprobation certain real or supposed men who in the past have opposed, on scientific grounds, views which afterward turned out to be correct. This is just what every man does who has an

engine to run without fuel, or a patent gun which is to destroy the largest armored ship. Mr. Hovey represents those who differ from him as men who pronounce untrue that which they cannot explain; and all the way through he imagines himself talking about people who deny his facts. Now, there are no such people worth talking about, and there is no question of fact at issue. The real state of the case is, that he has a theory for explaining admitted facts, and the only men he has to oppose are those who do not believe that he has established his theory. The admitted facts are certain phenomena known as mind-reading, and certain acts of copying drawings by a blind-folded person not in contact with any other person. The contested theory is that these facts prove the transfer of thought from mind to mind without the intervention of any physical agency. Those who refuse to accept this theory may or may not have a theory of their own: it is not at all incumbent on them to form one. They may say that they meet with phenomena which they cannot explain, every day of their lives, and that this is amongst them. The psychic societies were organized for the express purpose of investigating the subject, and finding out what theory, if any, was the correct one. If there were not some question as to how the phenomena should be explained, there would be little occasion for a psychical society.

TEXT-BOOKS IN CHEMISTRY AND MINERALOGY.

THE lecture-notes on general chemistry, by Dr. J. T. Stoddard, are, as the title indicates, merely an outline which should be the basis of a student's notes in a course of experimental lectures. A few general principles of the science are given briefly, and then follow statements of the properties, uses, history, method of preparation, and occurrence, of the commonest of the non-metals and their compounds. The appendix contains some tables and hints as to the methods of chemical calculation. From its briefness, the book can be of little value except as a suggestion of some elementary facts which the beginner should learn; and its use as an outline for the basis of a

Outlines of lecture-notes on general chemistry. Part I, The non-metals. By J. T. STODDARD. Northampton, Gazette publishing company, 1884. 84 p. 8°.

An outline of qualitative analysis for beginners. By J. T. STODDARD. Northampton, Gazette printing company, 1883. 4+54 p. 8°.

Systematic mineral record, with a synopsis of terms and chemical reactions used in describing minerals. By E. M. SHEPARD. New York, Barnes, 1884. 26 p. 8°.

Mind-reading and beyond. By WILLIAM A. HOVEY. Boston, Lee & Shepard, 1885.

student's notes will be confined to institutions where lectures on chemistry are not extensive. The book, describing only a few of the commoner and well-known compounds, is for the most part accurate. Dr. Stoddard has divided the elements into metals and non-metals, according to their periodic functions, placing bismuth, tin, antimony, and arsenic among the latter. We think it simpler and less confusing to the student if only the elements which have no basic properties are included among the non-metals. According to Dr. Stoddard's division, we see no reason why lead should not be classed as a non-metal.

The general arrangement of the qualitative analysis, by the same author, differs but little from that of other manuals. There is a close resemblance to the form of the 'lecture-notes' on the same subject by Prof. Henry B. Hill; the difference, however, in point of clearness and conciseness, not being in favor of the 'outline.' A small manual of qualitative analysis should be of such arrangement that it may be used on the laboratory-desk; and the method of regular analysis should be given in a continuous form. The methods described for the basic analysis are not always those which we have found to give the best results in the average student's hands; and the reactions given for the detection of the acids are decidedly meagre. We see nothing in the book that is new, or of any advantage over the manuals of qualitative analysis now in use.

The systematic mineral record, by Prof. E. M. Shepard, is intended to accompany any text-book of mineralogy, and will be of great help to the student in the systematic examination of minerals. Its chief feature is the extremely clear and minute explanation of the various physical and optical characteristics which enable one to determine the nature of the specimen; and the definitions are illustrated by examples of well-marked types.

NOTES AND NEWS.

DR. BENJAMIN APTHORP GOULD is to return to this country very soon from South America, where he has recently completed the observations upon which he has been engaged for so long a time at the observatory of Cordoba. His fellow-citizens of Boston propose to give him a reception and a dinner on his return.

—The British steamship *Venetian*, Capt. Traut, reports that on March 22, at seven P.M., in 43° north, 51° west, the sea was very much agitated, and breaking in all directions; that this condition lasted half an hour, and could not have been caused by the

changes in the wind. It had the appearance of a very heavy tide race.

—A number of electrical storms are reported by vessels in the North Atlantic from March 9 to 13, and at various points off the coast from Cape Hatteras to Cape Cod. St. Elmo's fire was seen in most of the cases, and many of the storms were accompanied by heavy thundering and lightning.

—The Lyceum of natural history of Williams college, Williamstown, Mass., the oldest natural-history society but one connected with any college in the country, will celebrate its fiftieth anniversary on the 24th of this month, at which a former member, Dr. W. K. Brooks of the class of 1870, now associate of Johns Hopkins university, will deliver an address. The lyceum proposes to take advantage of the occasion to raise funds to enable it to undertake expeditions to some spot, similar to those which it has undertaken in former years to Labrador, Florida, etc.

—The first number of the *American journal of archaeology* reflects much credit upon the editorial management, and warrants the expectation that it will supply a greatly needed want to the students of archeological science in all its numerous branches. For this reason we regret the more, that, in the initial number of an American journal, the topic of American archeology should be conspicuous by its absence. This, we understand, has not arisen from neglect upon the part of the editors; and arrangements have already been made to remedy it. The original articles are not numerous, but all are of undoubted merit and interest. Professor Norton revives the memory of the earliest American classical archeologist, Mr. J. J. Middleton, of the well-known South-Carolina family of that name. He was the companion of Dodwell in his studies of the Pelasgic remains in Italy, but preceded him by six years in publication. Some of his drawings were reproduced in the well-known posthumous publication of Dodwell, but no credit was given to the American scholar. Mr. Waldstein contributes the substance of an important note to his forthcoming 'Essays on the art of Phidias,' correcting the misconception as to the artistic significance of the peplos group on the eastern frieze of the Parthenon. The longest paper is by Prof. Aug. C. Merriam, a study of inscriptions found upon a collection of sepulchral vases from Alexandria, now in New York. It is most creditable to American scholarship, and a decided addition to knowledge. The managing editor, Dr. A. L. Frothingham, jun., begins a series of articles on the relative excellence of Italian and French sculpture during the thirteenth century, in a very entertaining fashion; and Mr. Marsh gives a lucid summary of a remarkable essay by Dörpfeld, which has shed a flood of light upon the origins of Doric architecture, and its relations to earlier crude brick construction. More than half the number is devoted to book-notices, summaries of the contents of the more important archeological periodicals of Europe, and news items about discoveries, and the

labors of explorers in various countries of the old world. This promises to be one of the most valuable features of the new enterprise, which we commend most heartily to the support of all who have any interest in the study of antiquity.

— The new entomological journal, published under the auspices of the Brooklyn entomological society, under the extraordinary title of *Entomologica (sic!) Americana*, has just appeared. It is of about the size and general appearance of *Papilio*, which, and the former *Bulletin* of the Brooklyn society, it supplants. It does not differ in general character from them.

— The second of the papers by Drs. Tamburini and Seppilli on their experimental investigations in hypnotism has appeared in German translation by Dr. Fränkel of Bernburg. The first half of the pamphlet is occupied by an account of experiments and facts observed, while the last half gives their deductions from the facts. The division made by Charcot, of the phenomena, into those of the lethargic, cataleptic, and somnambulistic states, is accepted, and directions given for producing each of these states; but the three conditions are not regarded as in their ultimate nature different. All three are regarded as due to hyper-excitability of the whole cerebro-spinal axis, differing among themselves only as the irritability is greater or less. One of the arguments urged in favor of this view is from the fact that an irritation which will produce at first the lethargic state, will, if intensified, produce the cataleptic, and, upon being made still more intense, the third state, or somnambulistic, characterized by a stiffening of all the muscles. The experiments seem to have been carefully made, and the pamphlet is of real value.

— Three pages of the Bryennios manuscript, reproduced by photography from the original text, and edited, with notes, by J. Rendel Harris, associate professor of New-Testament Greek and paleography in the Johns Hopkins university, are now on the point of publication. These pages include the last verses of the Epistle of Barnabas; the superscription and opening of the first Epistle of Clement; the close of the second Epistle of Clement; the first verses of The teaching of the apostles; the last verses of the Epistle of Ignatius to the Romans, etc. A few copies are offered for sale at one dollar net. The edition is strictly limited to one hundred and twenty-five copies, and orders should therefore be sent at once to the publication agency of the Johns Hopkins university, Baltimore, Md.

— The recent announcement of the suspension of a daily paper called *The dial*, published in New York during the past year, has given an impression that the monthly journal *The dial*, published in Chicago, is the one referred to. *The dial* has just closed successfully its fifth year with the April number, just issued.

— The British steamship *Chicago*, Capt. Jones, reports March 13, 49° 48' north, 12° 53' west, eight P.M., to midnight, in 50° 5' north, 13° 48' west, the observation of a very brilliant aurora borealis. The

display extended in an arch from north-east to north-west, and from the horizon to the zenith, the whole appearing to be arranged in concentric rings of different brilliant colors. The night was so light from this cause, that a newspaper was read on deck.

— The electrical exhibition held at the observatory of Paris was opened on the 21st of March. A series of lectures is being delivered on electricity, the first being by Mr. Wolf, on the application of electricity to astronomy, and the last by Mr. Marié-Davy, on the use of electricity in prognosticating the weather. The lectures will be published.

— In the report of Professors Sedgwick and Nichols of the Massachusetts institute of technology, who were instructed by the Massachusetts board of health to investigate the subject of 'water-gas,' we find that they are averse to the general introduction of this gas for illuminating-purposes. Ordinary coal-gas contains about seven per cent of carbonic oxide, whereas water-gas contains as much as thirty per cent. This large percentage of poison in the gas would render its introduction, even under the most careful precautions, extremely dangerous to life. In an atmosphere containing one per cent of coal-gas, dogs, cats, rabbits, and pigeons were apparently able to resist the effect of the carbonic oxide almost indefinitely; while, on the other hand, with the same amount of water-gas, death from poisoning generally resulted after from five to eight hours of exposure. Coming from such a source, this report must have much weight in settling this much-vexed question.

— Dr. George H. Horn of Philadelphia was elected an honorary member of the Entomological society of France at its meeting of March 11.

— The influence the merchant may have on science by well-directed efforts is well exemplified in the career of Godeffroy, who recently died in Germany, and who was, until lately, head of the great German firm of traders to the South-Sea Islands. He was, however, says *Nature*, much more than a merchant. Besides captains and supercargoes, he sent to Micronesia, Melanesia, Polynesia, and especially to Samoa, men of science, whose duty it was to make collections and send them to Hamburg, to form there an exhaustive museum of natural history. The first whom he sent out on a mission of this kind was Dr. Graefe of Zurich, now inspector of the zoölogical station at Trieste, who went to Samoa in 1861, and, from this as a centre, visited the Fiji, Tonga, and other groups in the region. He returned to Europe after eleven years, bringing with him important collections, and he undertook the editorship of a *Journal of the Godeffroy museum*. Amongst others thus despatched to the South Seas, was a lady who spent ten years studying the botany of northern Queensland, and a Polish surgeon who lived for five years in the Marshall and Caroline Islands, then returned to Europe, returning again to the Carolines, where he is at present. A list of the men employed by Godeffroy to travel in the South Seas to study the various islands, make collections for his museum, and report to him, would embrace all nationalities, all de-

partments of study, and every portion of the southern Pacific. Eight catalogues of the museum were published between 1864 and 1881, several of them containing zoölogical and geographical monographs as well. The *Journal*, which commenced in 1871, contained not only papers on the museum and its contents, but was open to the discussion of any scientific subject connected with the South-Sea Islands. Its most important feature was formed by the papers, by specialists, on sections of the collections sent home for the museum. Fourteen parts were published in all, the most remarkable being on the fishes, which contained 140 plates and 312 illustrations. Through financial reverses, this princely merchant died poor; and no purchaser was found for his museum, which will probably be broken up.

— According to the *Auk*, the celebrated collection of birds' eggs belonging to Dr. Baldamus of Coburg, Germany, is now offered for sale. A printed catalogue of the collection has been prepared; and it appears that the collection, which is especially rich in the nests and eggs of European birds, numbers nearly two thousand species and some ten thousand specimens. It would be a valuable accession to any museum in this country.

— The electric light has found a novel use recently in the attempt to apply it for the prevention of such explosions as have lately taken place in London. An arc-light of fifty Carcels was employed on one of the police-boats of the Thames to light the Speaker's terrace or the Westminster bridge. It was found that the movements of individuals on the land, or of boats on the river, could readily be followed. As the police-boats are too small to allow of the use of dynamo-electric machines, recourse was had to primary batteries, a chloride-of-silver battery of the form invented by Skrivanow being used, which did not occupy more than a cubic foot of space.

— The governor of Indiana has appointed Maurice Thompson of Crawfordsville to be state geologist, in place of Professor John Collett, whose term expires April 26. Mr. Thompson is known only as a writer upon out-door recreations and popular science. The reason for not re-appointing Mr. Collett is not given, and, if he was to be supplanted by another, it should have been by a thoroughly competent person.

— The managers of the Indiana institution for the deaf and dumb at Indianapolis have procured cases for a museum of considerable extent. They have a very good room in their building for this purpose. The idea of object-teaching in natural science to deaf-mutes is a good one, and will undoubtedly be followed by good results.

— In the programme of prizes for award, presented at the recent annual meeting of the Académie des sciences, was included a prize of four thousand pounds, left by Bréant in 1849, and still unawarded, to be given to any one who "shall find an efficacious remedy for Asiatic cholera, or shall discover the causes of this terrible scourge." To secure this prize, it will be necessary, 1, to find a means of curing Asiatic cholera in the immense majority of cases; 2, or to indicate

with absolute certainty the causes of Asiatic cholera, so that by their suppression the epidemic shall cease; 3, or to discover a certain prophylactic as infallible, for instance, as is vaccination for small-pox.

— Dr. and Mrs. Asa Gray and Dr. W. G. Farlow visited the city of Mexico on their way to southern California. They were tendered a reception by the Historical society of southern California at Los Angeles, March 16, where Dr. Gray, though suffering from a severe cold contracted at New Orleans, made a few pleasant remarks, and was followed by an address on fungi affecting fruit-trees, by Professor Farlow. The party visited San Diego, where, unfortunately, unpleasant weather prevailed: they intend visiting other points of botanical interest.

— Pasteur's system of vaccination for anthrax has been tried with triumphant success by the Indian government, acting on the advice of Mr. J. Mills, the inspector of cattle-disease for Madras. According to the official papers, ponies, donkeys, cows, bullocks, buffaloes, sheep, and guinea-pigs have all been protected by vaccination from the consequences of inoculation with virus which proved fatal to unvaccinated animals. A vaccinated pony and a buffalo were sent to a village where there was an epidemic of anthrax; and though they were herded with diseased cattle, and grazed on the same pastures, they escaped the disease. In Burmah the elephants have been vaccinated with equal success. At first the 'vaccine' was imported from France; but the uncertainty of obtaining it pure and efficacious from any one but Pasteur himself has induced the Indian government to fit up a laboratory for the manufacture and dispensing of the fluid in Bengal; and, if that is successful, other laboratories will be founded in other centres. Mr. J. H. B. Hallen was sent, some time ago, to study in Pasteur's laboratory; and the report recommends that all veterinary surgeons should go through such a course of instruction.

— The Paris industrial exhibition for 1885 will be held from July to November in the galleries of the Palais de l'Industrie. It has been decided to form three foreign sections, — one for England, another for Belgium, and a third for Italy, — in order that the processes adopted by the French workmen may be fairly compared with those of the countries named.

— Some inquiries having been made of us concerning the accuracy of the times of the occurrence of the solar eclipse of March 16 for some of the principal cities of the United States, published in *Science* last Christmas, we would say that it was not designed to furnish accurate predictions for the use of astronomers, who are in the habit themselves of performing such calculations specially for their respective points of observation, but simply to give near approximations for the use of the public at large; the times of ending being given with a little less degree of exactness than those of beginning, which latter, as far as heard from, agreed with observation within the minute, and the whole believed to have answered all practical ends.